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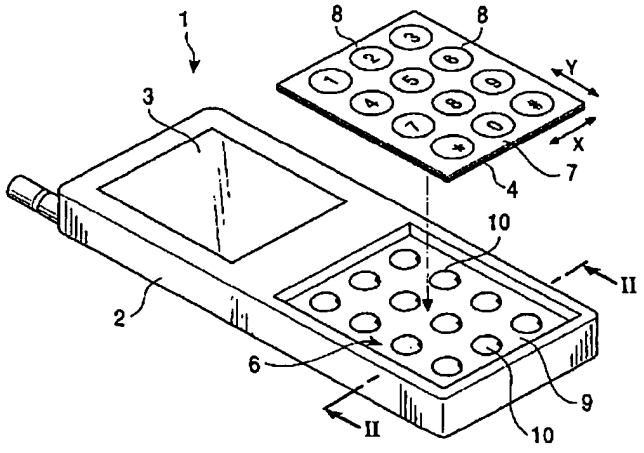
(54) Input device which allows button input operation and coordinate input operation

(57) An input device (1) including a planar input unit (4) which is a pressure-sensitive-tpye or a capacitance-type unit, with an indicator sheet (7) which has input sections (8) being secured to the surface of the planar input unit. An operation feel generating unit (6) is provided at the back side of the planar input unit. The operation feel generating unit includes dome-shaped inversion plates (10) that are separately provided at locations corresponding to the input sections. When an input section is pressed, an operation signal in accordance with what is indicted at the pressed input section is generated in order for an operator to feel the operation that he/she carried out as a result of the pressing reaction force of the inversion plate.

FIG. 1



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Descripti n

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an input device which allows a button input operation and a coordinate input operation to be performed in the same operation plane.

2. Description of the Related Art

[0002] An input device, such as a portable telephone, includes, for example, a pushbutton input means, and can be used to perform various operations, such as inputting a telephone number and starting/ending talking on the telephone.

[0003] In recent years, internet connecting environments making use of portable telephones have tended to increase, so that various services are being provided using portable telephones. Accordingly, various menus are displayed on displays of portable telephones, and menu selections are frequently made.

[0004] When menu selections are being made using conventional input devices, a menu selectable location is moved by a push-type or a stick-type direction-indicating input means which is provided separately of the pushbutton input means of a portable telephone.

[0005] However, the above-described conventional input device has the problem that its operability is impaired because the pushbutton input operation and the menu selection input operation are carried out using different input means. In addition, the conventional input device has difficultly allowing quick menu selection because the directions in which menus are moved are limited to the vertical directions (upward and downward directions) or the horizontal directions (leftward and rightward directions).

SUMMARY OF THE INVENTION

[0006] Accordingly, in order to overcome the above-described problems, it is an object of the present invention to provide an input device which allows a predetermined input section to be pressed and which allows cursor movement when, for example, carrying out menu selection, without impairing the operability of the input device.

[0007] It is another object of the present invention to provide an input device which makes it possible for an operator to reliably know that he/she has pressed the input device.

[0008] To these ends, according to a basic form of the present invention, there is provided an input device comprising planar input means for allowing a coordinate input operation; indicator section provided at a surface of the input means, the indicator section indicating a plurality of input sections; and a control section for generating an operation signal in accordance with an input signal that the control section has received from the input means. When the input device is set in a predetermined input mode, the control section detects that any one of the input sections has been touched, and generates an operation signal in accordance with a prescribed item of the input section. On the other hand, when the input device is set in another mode, the control section recognizes the input signal from the input means as coordinate data regardless of what is indicated at the touched input section.

[0009] In the basic form, the operation of any one of the input sections and the input operation of coordinate data that is carried out without considering the input section can be carried out in the same operational plane. Therefore, large movements of fingers are not required, so that the operability of the input device is not impaired.

[0010] In one form of the basic form of the present invention, the input device further comprises display means disposed beside the input means. When the input device is set in the another mode, the display means provides a display in correspondence with the coordinate data.

[0011] In still another form of the basic form of the present invention, the input device further comprises operation feel generating means for providing a pressing reaction force that is produced when any one of the input sections formed at the indicator section is pressed.

[0012] The input device may comprise a plurality of the operation feel generating means that are separately provided at locations in correspondence with the input sections formed at the indicator section.

[0013] When the input device further comprises operation feel generating means for providing a pressing reaction force that is produced when any one of the input sections formed at the indicator section is pressed, the operation feel generating means may be provided at only one location at the back side of the input means.

[0014] When the input device comprises a plurality of the operation feel generating means that are separately provided at locations in correspondence with the input sections formed at the indicator section, the operation feel generating means may be formed using dome-shaped inversion plates disposed at the back side of the input means.

[0015] By virtue of this structure, the operator can know that he/she has performed a pressing operation, so that it is possible to prevent, for example, the operator from forgetting to perform the pressing operation. Therefore, it is possible for the operator to reliably perform the pressing operation.

[0016] When the operation feel generating means is formed using dome-shaped inversion plates disposed at the back side of the input means, a switch input operation may be performed by the inversion plates.

[0017] In this case, since the switch input operation is not performed until any one of the inversion plates is

inverted, it is possible to prevent an input operation when the indicator section is only touched.

An embodiment of the present invention, will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:

Fig. 1 is an exploded perspective view of a first embodiment of an input device in accordance with the present invention.

Figs. 2A and 2B are sectional views taken along line 2-2 of Fig. 1, in which Fig. 2A shows a state of the input device before the operation thereof and Fig. 2B shows a state of the input device during the operation thereof.

Fig. 3 is a block diagram showing the functions of the input device.

Fig. 4 is a flowchart of switching between input modes.

Fig. 5 is a sectional view of a operation feel generating means.

Fig. 6 is an exploded perspective view of a second embodiment of an input device in accordance with the present invention.

Figs. 7A and 7B are sectional views taken along line 7-7 of Fig. 6, in which Fig. 7A shows a state of the input device before the operation thereof and Fig. 7B shows a state of the input device after the operation thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Fig. 1 is an exploded perspective view of a first embodiment of an input device in accordance with the present invention. Figs 2A and 2B are sectional views taken along line 2-2 of Fig. 1, in which Fig. 2A shows a state of the input device before the operation thereof and Fig. 2B shows a state of the input device during the operation thereof. Fig. 3 is a block diagram showing the functions of the input device. Fig. 4 is a flowchart of switching between input modes.

[0019] An input device 1 shown in Fig. 1 is that formed as a result of conceiving a portable telephone. In the input device 1, a display panel 3, serving as a display means, and a planar input unit 4, serving as an input means, are mounted to a case 2. The display panel 3 is a monochromic or a color liquid crystal display panel or an EL panel.

[0020] For the planar input unit 4, a capacitance type or a pressure-sensitive type may be mounted. In the capacitance type, an X-direction detecting electrode and a Y-direction detecting electrode, both of which are formed of Ag (silver) paste, oppose each other in a matrix arrangement at the top and bottom sides of a resin sheet formed of, for example, PET (polyethylene terephthalate) having an insulating property and a predetermined dielectric constant. By disposing the resin sheet and the electrodes on a substrate having an electrically conductive pattern formed on a resin sheet, the input unit 4 is made bendable. This makes it possible to input a coordinate when a dielectric member, such as the operator's finger, touches the surface of the planar input unit 4.

[0021] The pressure-sensitive type includes a resistor having a potential difference provided in the X and Y directions, and a conductor member opposing the resistor. When the input unit 4 is pressed with, for example, the operator's finger, the conductor member and the resistor are brought into contact with each other, thereby changing the resistance value. This makes it possible to input a coordinate.

[0022] An indicator sheet (indicator section) 7 is placed upon and secured to the operating-side of the planar input unit 4. (See Figs. 1 and 2A and 2B). The indicator sheet 7 is a resin sheet formed of, for example, PET, and has a plurality of input sections 8 of, for example, numbers and symbols printed on its surface. In addition, circular frames indicating the input allowing locations are formed around the numbers and symbols, so that they are formed within their corresponding frames.

[0023] An operation feel generating means 6 is provided at the back side of the planar input unit 4. The operation feel generating means 6 has a glass-epoxy-resin or a metallic base 9 provided inside the case 2, with dome-shaped (diaphragm-like) inversion plates 10 being formed on the base 9. The inversion plates 10 are provided separately at locations in correspondence with the input sections 8.

[0024] In the state shown in Fig. 2A prior to the operation of the input device 1, neither the planar input unit 4 nor the indicator sheet 7 are deformed. In addition, the inversion plates 10 are maintained in their dome-shaped forms. In this state, when a desired input section is pressed from above by the operator's finger or with a pen, the planar input unit 4 and the indicator sheet 7 are both bent and deformed, and are in depressed states. When the corresponding inversion plate 10 is inverted by the pressing force that is produced at this time, a pressing reaction force is produced by the corresponding inversion plate 10. This pressing reaction force is transmitted to the operator's finger so as to cause the operator to experience a tactile feel. Therefore, the operator can know that he/she has definitely pressed the corresponding inversion plate 10.

[0025] As shown in Fig. 3, the input device 1 includes a control section 21. The display panel 3 and the planar input unit 4 are connected to the control section 21 in order to be controlled thereby. In addition, a transmitting section 22, a receiving section 23, and a storage section 24 are connected to the control section 21. Sound signals and data signals are transmitted from the transmitting section 23 to the outside and received by the receiving section 23 from the outside. Telephone number data, various setting data, and display data to be displayed on the display panel 3 are stored in the storage section 24.

[0026] The control section 21 allows two different types of input operations in two modes, a predetermined input mode and a different input mode (called "the other input mode"). When the input device 1 is set in the predetermined input mode, a detection is made that a corresponding input section 8 has been pressed with, for example, the operator's finger. Then, in correspondence with a prescribed item indicated at the corresponding input section 8, an input signal is applied in order to generate an operation signal based on this input signal. When the input device 1 is set in the other input mode, regardless of what is indicated at the corresponding input section 8, a detection that the surface of the planar input unit 4 has been slid with, for example, the operator's finger is made in order to provide an input signal. In the other input mode, the input signal is recognized as coordinate data in order to generate an operation signal.

[0027] When the input device 1 is set in the predetermined mode, the display panel 3 provides a display of, for example, numbers, which can be input. When the input device 1 is set in the other mode, the display panel 3 provides, for example, a display which allows menu selection, or a display which allows the movement of a displayed cursor.

[0028] For example, when a homepage (that is, a web page) is displayed on the screen of the display panel 3, a cursor is displayed on the display panel 3, and can be moved freely in various directions in an X-Y plane by an input operation of the planar input unit 4. When the cursor is moved in order to determine the menu selection location, an operation for determining the menu is subsequently carried out. This determination operation may be executed, for example, by tapping the surface of the planar input unit 4 or by operating an operating member that is provided separately of the planar input unit 4 inside the case 2. The detection of the tapping operation is made possible by distinguishing between changes in the load when a corresponding inversion plate 10 is pushed and inverted and changes in the load when a corresponding inversion plate 10 is tapped and is not inverted.

[0029] In the input device 1, the predetermined input mode and the other input mode are processed by the control section 21 using software. This allows automatic switching between the input modes, so that switching between displays on the display panel 3 in accordance with the input modes can be performed.

[0030] A description of the processing operation at the control section 21 of the input device 1 will now be given.

[0031] As shown in Fig. 4, in Step 1 (ST1), a determination is made as to whether the input device 1 is in the predetermined mode, that is, in a state which allows an input operation in correspondence with the prescribed item that is indicated at a corresponding input section 8. When a determination is made that the input device 1 is in the predetermined input mode (that is, when the answer is "Yes") in ST1, the process proceeds to ST2 in which the screen of the display panel 3 provides a display in correspondence with the prescribed item at the corresponding input section 8. Then, the process proceeds to ST3. When the corresponding input section 8 of the planar input unit 4 is pressed, an input signal based on the prescribed item of the pressed input section 8 is generated. In ST4, when an operation signal based on the input signal is generated, the display panel 3 provides a display in correspondence with the operation signal.

[0032] When a determination is made that the input device 1 is in the other mode (that is, when the answer is "No") in ST1, the process proceeds to ST5 in order for the display panel 3 to provide a screen display in correspondence with the input coordinate data, such as a menu selection screen display or a cursor movement screen display. Then, the process proceeds to ST6. When the planar input unit 4 is operated, an input signal which has nothing to do with what is indicated at the corresponding input section 8 is generated from the planar input unit 4. Thereafter, the process proceeds to ST7 where the input signal is recognized as coordinate data. The display panel 3 provides a display in correspondence with this coordinate data.

[0033] In the input device 1, the inversion plates 10 are simply dome-shaped metallic plates for allowing the operator to feel the operation that he/or she has carried out. However, these inversion plates 10 may be formed so as to allow switch input operations as a result of being inverted.

[0034] In Fig. 5, the illustrated inversion plate 10 is constructed as a switch element 11 which can be used for a switch input operation.

[0035] As shown in Fig. 5, the switch element 11 comprises an electrically conductive pattern 13b and an electrode 13a, serving as conductor members formed of Ag paste. They are formed by printing or the like into patterns on both sides of a resin sheet 12 (formed of PET).

[0036] The electrode 13a is formed on the top surface of the resin sheet 12, with a circular electrode 13a1 being formed in the center thereof, and an annular electrode 13a2 being formed around and at a predetermined distance from the electrode 13a1. An electrically conductive pattern is formed continuously with a portion of the electrode 13a2. The electrically conductive pattern 13b is formed at the bottom surface of the resin sheet 12, and is connected to the electrode 13a1. A through hole is formed in a portion of the resin sheet 12 below the electrode 13a1. A coupling conductor member 14 for bringing the electrically conductive pattern 13b and the electrode 13a1 into electrical conduction is formed in the through hole. A dome-shaped (diaphragm-like) inversion plate 15 is formed on the electrode 13a2. The inversion plate 15 is provided so that its peripheral edge is in contact with the electrode 13a2 and so that the location of the top portion of the inversion plate 15 and the location of the electrode 13a1 correspond with each

other.

[0037] Resist films 16a and 16b are provided around the inversion plate 15 and at the bottom surface of the electrically conductive pattern 13b, respectively. The entire surface is laminated with a resin sheet 17 formed of PET, and a resin or a metallic base 18 is coupled to the bottom surface of the resist film 16b through an adhesive layer 19, whereby the switch element 11 is constructed.

[0038] When the operator presses the planar input unit 4 with his/her finger from thereabove, the planar input unit 4 and the indicator sheet 7 are elastically deformed, and the corresponding inversion plate 15 is pushed by the pushing force produced by the operator. This causes the inversion plate 15 to be inverted as shown by the alternate short and long dashed lines in Fig. 5, so that the inversion plate 15 comes into contact with the electrode 13a1. As a result, the electrode 13a and the electrically conductive pattern 13b are brought into electrical conduction with each other, causing the switch output to be switched to an ON output. Therefore, in the above-described case, the input signal generated at the planar input unit 4 is ignored. In addition, by inverting the inversion plate 15, the operator feels the operation he/she has carried out as a result of the pressing reaction force produced at this time.

[0039] A description of a second embodiment of an input device in accordance with the present invention will now be given with reference to Figs. 6 and 7. Fig. 6 is an exploded perspective view of the second embodiment of the input device. Figs. 7A and 7B are sectional views taken along line 7-7 of Fig. 6, in which Fig. 7A shows a state of the input device prior to the operation thereof, and Fig. 7B shows a state of the input device during the operation thereof.

[0040] An input device 30 shown in Fig. 6 is that formed as a result of conceiving a portable telephone. A display panel 3, serving as a display means, and a planar input unit 31, serving as an input means, are mounted to a case 2. The structural features of the input device 30 are the same as those of the input device 1, except that a planar input unit 31 differs from the planar input unit 4. Therefore, the same structural features will not be described below.

[0041] The planar input unit 31 may be a pressure-sensitive type or a capacitance type. In the capacitance-type planar input unit 31, as described above, an X-direction detecting electrode and a Y-direction detecting electrode oppose each other in a matrix arrangement, with a PET (polyethylene terephthalate) resin sheet being sandwiched therebetween. The resin sheet having the electrodes formed thereon are provided on a rigid, glass epoxy or metallic substrate. An indicator sheet 7 similar to that used in the first embodiment is secured to the front side of the planar input unit 31, and an operation feel generating means 33 is provided at the planar input unit 31.

[0042] The operation feel generating means 33 has one protrusion 35 whose end is supported so as to be movable upward and downward. This one protrusion 35 is provided in a concave-shaped base 36, formed inside the case 2, and is formed at the center of the back side of the planar input unit 31. The protrusion 35 is formed so that it causes the operator to feel, for example, a pressing reaction force when he/she presses it from thereabove. The above-described dome-shaped inversion plate may be used to construct the operation feel generating means 33.

[0043] A pantograph 34 is provided as an ascending/descending means between the planar input unit 31 and the base 36.

[0044] As shown in Fig. 6, the planar input unit 31 is supported so as to be movable upward and downward by the pantograph 34.

[0045] In the state of the input device 30 prior to the operation thereof shown in Fig. 6, the pantograph 34 is slightly raised, so that the planar input device 31 is positioned at the upper end along with the indicator sheet 7. At this time, the planar input unit 31 may be raised by the elastic force of the protrusion 35 or by an electric member (not shown), such as a coil spring, provided at the base 36.

[0046] Therefore, when the operator pushes the planar input unit 31 with, for example, his/her finger from thereabove, the pantogragh is folded, causing the entire indicator sheet 7 and planar input unit 31 to be pushed down horizontally. As a result, the operator feels the operation that he/she has carried out as a result of, for example, the pressing reaction force produced when the protrusion 35 is pushed. Consequently, the operator can reliably know that he/she has pressed the planar input unit 31.

[0047] Similarly to the input device 1, the input device 30 includes a control section in order to perform switching between a predetermined input mode and a different mode (the other input mode). The switching between the predetermined input mode and the other input mode is performed by the same processing operations described above.

[0048] The input device of the present invention is not limited in its application to a portable telephone. For example, it may be formed so that the predetermined input mode is set as a television remote control mode and the other input mode is set as a game device controller mode.

[0049] As can be understood from the foregoing description, since the input operation in the input mode for generating an operation signal in correspondence with the input section, and the input operation in the input mode for generating coordinate data can be carried out in the same operational plane, quick input operations can be achieved without impairing operability.

[0050] In addition, since the reaction force that is produced when the operator presses an input section is transmitted to the operator, the operator is capable of knowing that he/she has definitely performed a pressing

operation, thereby making it is possible to restrict erroneous operations.

Claims

1. An input device comprising:

   planar input means for allowing a coordinate input operation;
   indicator section provided at a surface of the input means, the indicator section indicating a plurality of input sections; and
   a control section for generating an operation signal in accordance with an input signal that the control section has received from the input means,

   wherein, when the input device is set in a predetermined input mode, the control section detects that any one of the input sections has been touched, and generates an operation signal in accordance with a prescribed item of the input section, and, wherein, when the input device is set in another mode, the control section recognizes the input signal from the input means as coordinate data regardless of what is indicated at the touched input section.

2. An input device according to Claim 1, further comprising display means disposed beside the input means, wherein, when the input device is set in the another mode, the display means provides a display in correspondence with the coordinate data.

3. An input device according to Claim 1 or 2, further comprising operation feel generating means for transmitting a pressing reaction force that is produced when any one of the input sections formed at the indicator section is pressed.

4. An input device according to Claim 3, comprising a plurality of the operation feel generating means that are separately provided at locations in correspondence with the input sections formed at the indicator section.

5. An input device according to Claim 3, wherein the operation feel generating means is provided at only one location at the back side of the input means.

6. An input device according to Claim 4, wherein the operation feel generating means are formed using dome-shaped inversion plates disposed at the back side of the input means.

7. An input device according to Claim 6, wherein a switch input operation is capable of being performed by the inversion plates.

FIG. 1

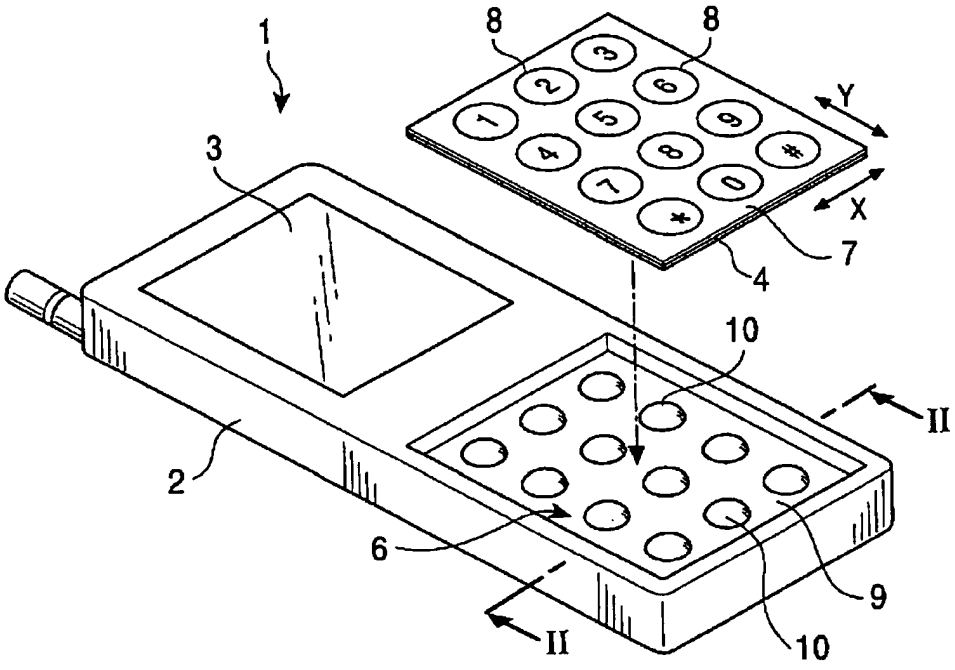

FIG. 2A

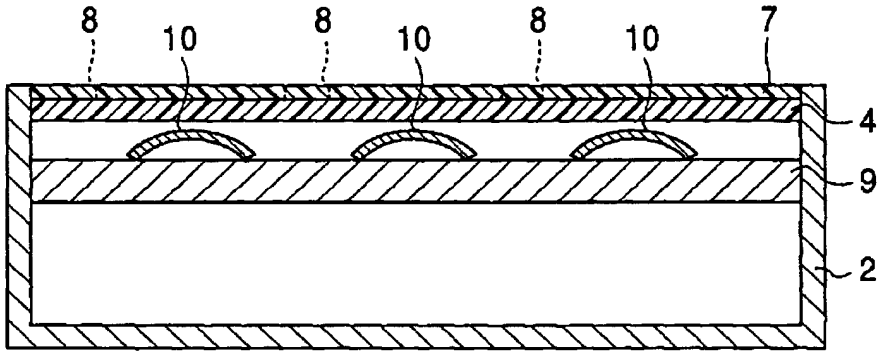

FIG. 2B

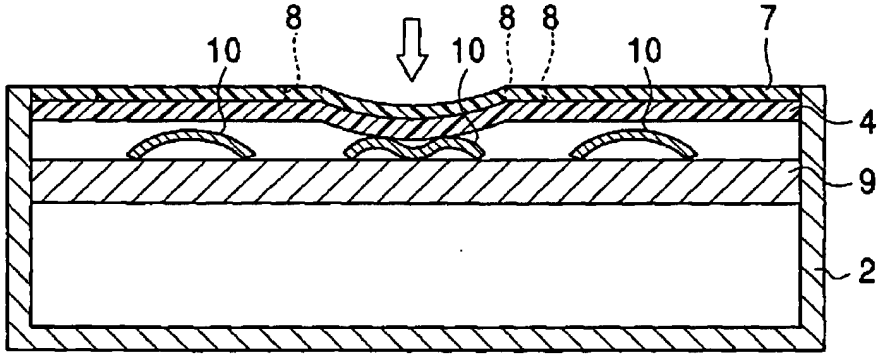

FIG. 3

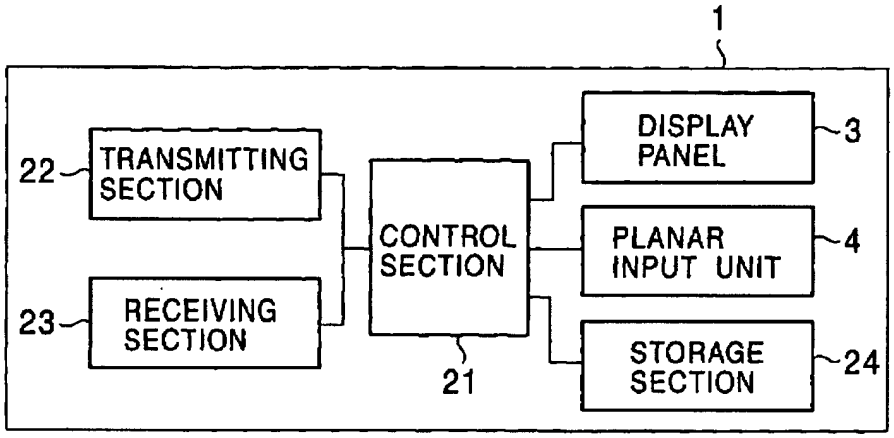
1
22
TRANSMITTING SECTION
23
RECEIVING SECTION
CONTROL SECTION
21
DISPLAY PANEL
3
PLANAR INPUT UNIT
4
STORAGE SECTION
24

FIG. 4

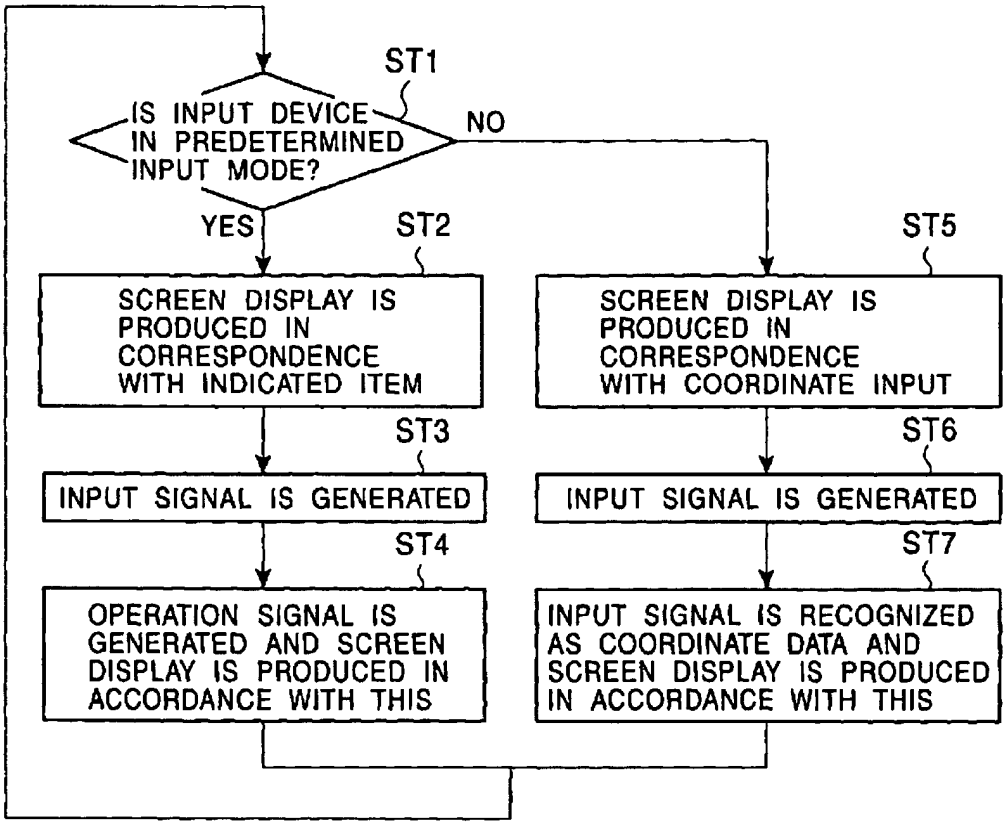
ST1
IS INPUT DEVICE IN PREDETERMINED INPUT MODE?
NO
YES
ST2
SCREEN DISPLAY IS PRODUCED IN CORRESPONDENCE WITH INDICATED ITEM
ST3
INPUT SIGNAL IS GENERATED
ST4
OPERATION SIGNAL IS GENERATED AND SCREEN DISPLAY IS PRODUCED IN ACCORDANCE WITH THIS
ST5
SCREEN DISPLAY IS PRODUCED IN CORRESPONDENCE WITH COORDINATE INPUT
ST6
INPUT SIGNAL IS GENERATED
ST7
INPUT SIGNAL IS RECOGNIZED AS COORDINATE DATA AND SCREEN DISPLAY IS PRODUCED IN ACCORDANCE WITH THIS

FIG. 5

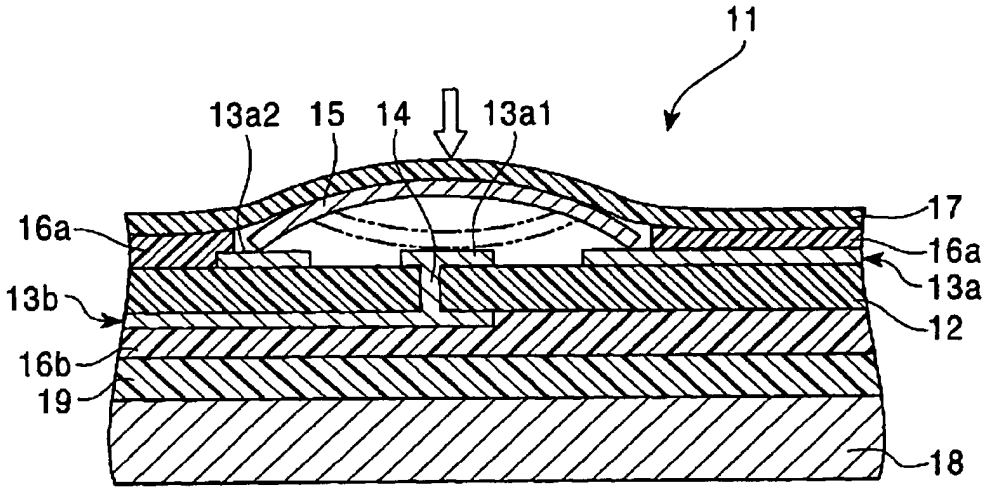

FIG. 6

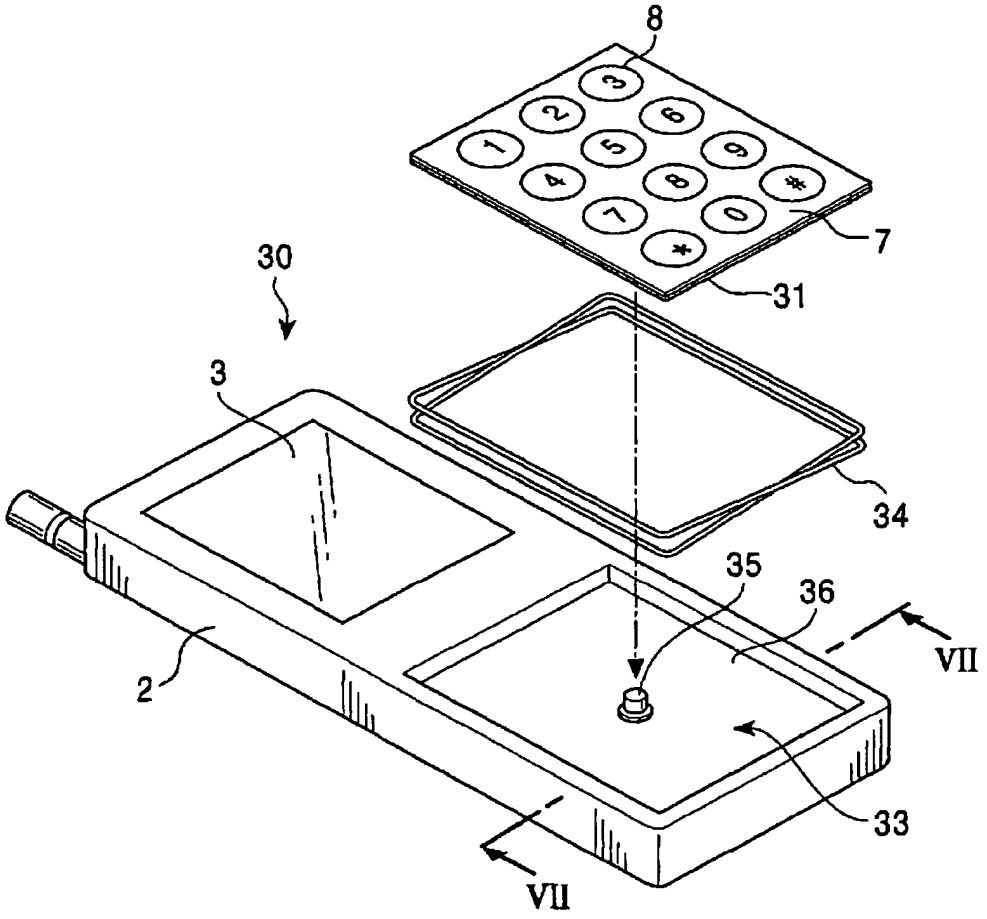

FIG. 7A

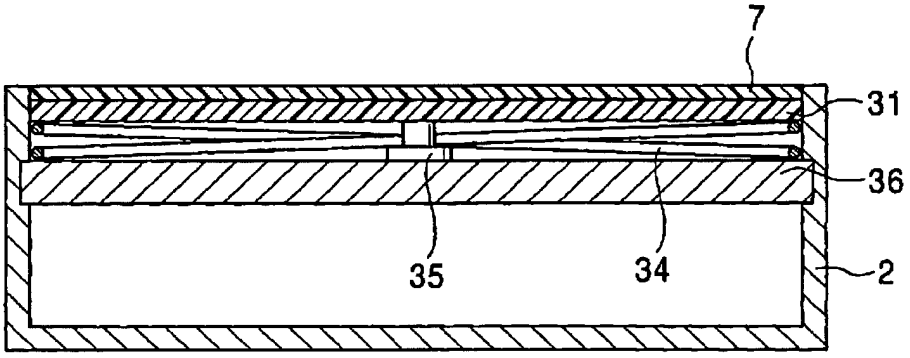

FIG. 7B